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THE NUTRITIVE VALUE OF INDIAN FOODS AND THE PLANNING OF SATISFACTORY DIETS

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DIETARY REQUIREMENTS.

Foodstuffs supply fuel for the body and they contain proteins, fats, carbohydrates, vitamins and various mineral salts. Proteins, fats and carbohydrates are sometimes known as the energy-yielding food factors, since they are " burnt " or oxidized in the body to provide the energy necessary for life. Vitamins and mineral salts do not supply energy in appreciable quantities, but they play an important part in the physiological functions of the body. Water is also a necessary dietary element. Human beings, like other animals, require a sufficiency of these if they are to live and thrive, and in a well balanced diet they are present in correct proportions. Our present knowledge of what constitutes an adequate or optimum diet is based on an enormous amount of research work on human beings and laboratory animals carried out in many countries. We have a very fair idea of how much of each food factor is required and we can state requirements in terms of common foodstuffs.

CALORIES.

In drawing up a new diet schedule, or in assessing the value of an existing schedule, it is essential to know whether enough food is being provided. It might be thought that it is easy to discover whether, let us say, a group of labourers or the boys in a boarding school are getting enough to eat ; if their food is insufficient, they will be hungry and complain about it. But experience has shown that human beings can adapt themselves, at a low level of vitality and with their powers impaired, to an insufficient ration, and scarcely realise that they are under-fed. The nutrition worker, in setting up standards of food requirements, ignores the remarkable faculty of the body to adapt itself to semi-starvation. His standard of food intake implies full satisfaction, enough to enable human beings to lead an energetic life at a reasonably high level of working capacity.

Quantitative food requirements are usually estimated in terms of heat units—calories. Let us first illustrate the problem to be discussed by a simple example. A group of coolies is provided with a ration of 17 ozs. of rice and 2 ozs. of pulse (dhal) per head per day, and very little food from other sources can be obtained by them. There are complaints that the coolies are lazy, that they work languidly and reluctantly. By reference to the Tables (p. 18) and a simple calculation, we discover that this amount of food would provide about 2,100 calories per day. The question arises : are they getting enough food ? Or, in other words, are 2,100 calories a day sufficient for an adult man performing manual work ?

An expert commission of the League of Nations* has drawn up the following statement about energy requirements :—

(*a*) *An adult, male or female, living an ordinary everyday life in a temperate climate and not engaged in manual work is taken as*

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*The Problem of Nutrition, Volume II. Report on the Physiological Bases of Nutrition 1936.

the basis on which the needs of other age-groups are reckoned. An allowance of 2,400 calories net per day is considered adequate to meet the requirements of such an individual.*

(*b*) *The following supplements for muscular activity should be added to the basic requirements in (a) :—*

Light work : up to 75 calories per hour of work.

Moderate work : up to 75—150 calories per hour of work.

Hard work : up to 150—300 calories per hour of work.

Very hard work: up to 300 calories and upwards per hour of work.

India is mainly an agricultural country and the " average Indian man " is engaged in a manual occupation. There are justifiable reasons for reducing " basic " calorie requirements in a warm country, in which the diet consumed is largely vegetarian, below the League of Nations standards. Let us suppose that an Indian male, of sedentary occupation, requires some 2,150 calories, a figure 10 per cent. below that of the League Commission. Six hours " moderate " work at the lowest reckoning, will involve an increase of requirements to roughly 2,600. We shall not be very far out if we reckon the minimum calorie needs of an average Indian, engaged in ordinary easy-going agricultural or coolie work as 2,500—2,600 calories per diem. Those who perform heavy manual work will probably require about 2,800—3,000 calories per day, as is indicated by the League Commission's figures; if the agriculturist is to work very strenuously on his holding, he must have a correspondingly high calorie intake. A similar high intake is required by athletic young men such as university students. It scarcely needs to be said that a large man working in a cold climate will require more food than a smaller man working equally hard in a warm climate.

It is usual to assess the food requirements of women and children as fractions of those of the " average man ", various co-efficients being applied to the different age and sex groups. The following scale of co-efficients and calorie requirements is put forward as sufficiently accurate for practical nutrition work in India :--

Scale of Average Calorie Requirements.

	Co-efficient.	Calories required.
Adult male (over 14)	1·0	2,600
Adult female (over 14)	0·8	2,080
Child 12 and 13 years	0·8	2,080
Child 10 and 11 years	0·7	1,820
Child 8 and 9 years	0·6	1,560
Child 6 and 7 years	0·5	1,300
Child 4 and 5 years	0·4	1,040
Child 2 and 3 years	0·3	780
Child 0 to 2 years	0·2	520

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* The term " net calories " refers to the amount of energy available from the food actually assimilated.

It must be emphasised that this scale is a somewhat arbitrary one. Physique, habits of life and other factors are so variable in different areas that no one scale of energy requirements and co-efficients could be entirely suitable for application throughout the country. A somewhat higher scale of requirements would perhaps be more appropriate for North India. It is possible that the proposed scale puts the requirements of an adult woman at too high a figure. During pregnancy and lactation, however, the needs of a woman may equal or exceed those of a man. The League of Nations Commission assesses requirements during these periods as follows :—

	Calories.
Pregnant woman	2,400
Nursing woman	3,000

These figures are definitely too high for Indian women, but they bring out the point that women need more food when they have to nourish a child in the womb or at the breast.

With the help of the Tables in the Bulletin, the calorie content of diets can be worked out and compared with requirements as suggested ; or, conversely, diet schedules yielding approximately the right number of calories can be constructed. In dealing with a group of mixed age and sex composition, the number of " consumption units " in the group —its " *adult man-value* " —is first calculated. Let us take a simple example. A family consisting of father, mother and 3 children aged 10, 8 and 6 respectively has a " man-value ", on the above scale, of 3·6, and its daily calorie requirements would work out at 2,600 × 3·6. If it is necessary to draw up a diet schedule for the family, food supplying roughly this number of calories should be included in the schedule. Suppose analysis of the existing diet of the family indicates that total intake per day is only 7,000 calories, *i.e.*, about 1,950 calories per " consumption unit ". Comparison of this value with the scale shows that the family is not getting enough to eat. The same method of approach is applicable in the case of larger groups in boarding schools, asylums, etc.

Commonsense must always be used in drawing up new diet schedules, or in assessing the adequacy of existing ones. It is usually better to err on the side of excess by 100—150 calories to allow for waste of all kinds, including the inevitable " leakage " of food which occurs in large institutions. Standards of calorie requirements are applicable only to reasonably large numbers, and not to individuals. The relation between calorie requirements and such factors as work, activity and climate must be borne in mind.

It might be thought that there is little danger that children or adults housed in charitable institutions under careful and well-meaning management should be under-fed. But experience has shown that this is not infrequently the case in India. Superintendents of children's institutions should take particular care that *enough* food is provided. The children themselves, often coming from homes in which they were half-starved, are not likely to complain of hunger in circumstances of *relative* abundance.

PROTEIN.

The next step, in constructing a balanced diet, is to ensure that it is satisfactory in quality. Protein is perhaps the most important of the food factors ; it supplies building material for the body and makes good the loss of tissue which occurs as the inevitable result of living at all. It can also be used by the organism as a source of energy.

As is apparent from the Tables, nearly all common foodstuffs contain protein, but the amount they contain varies widely. Animal foods such as milk, eggs, fish, and meat are rich in protein. The common cereals, such as rice, wheat, millet, barley, etc., contain a fair proportion of protein, rice being the poorest of all cereals in this respect. The outer layers of the grain are richer in protein than the inner starchy kernel, and when wheat and rice are highly milled there is some loss of protein as well as of other valuable food factors, such as vitamins and mineral salts. Among the vegetable foods, the pulses are richest in protein. Leafy and root vegetables, and fruits do not contain much protein, but if they are abundantly present in a diet their contribution to total protein intake is by no means negligible.

It is important to remember that growing children require, per unit of body weight, more protein than adults. The new tissue which is being laid down is largely built of elements drawn from protein. For the same reasons the protein needs of women during pregnancy and lactation are greater than at other times. The following scale of protein requirements is suggested as a rough guide for practical nutrition work :—

Protein requirements.

Age and sex.	Co-efficient.	Grammes per day.
Man 18 to 60	1·00	65
Woman 18 to 60	0·85	55
Boy 10 to 17	1·20	80
Girl 10 to 17	1·10	70
Child 6 to 9	0·90	60
Child 2 to 6	0·60 to 0·80	40—50

This scale falls short of the ideal as defined by modern physiologists, and may often with advantage be exceeded. It is nevertheless excessive, as far as India is concerned, in the sense that economic circumstances and dietary habits often prevent its attainment.

The total protein content of a diet can be estimated by means of the Tables. But more important than the total protein content of a diet is the proportion of protein of high biological value it includes. Proteins contained in various foods differ in their *amino-acid* constitution ; aminoacids are the bricks with which tissue is built and replaced, and the more closely the amino-acid make-up of a protein resembles that of the tissues the greater its value. Another factor to be considered in assessing the value of the proteins of a foodstuff is their digestibility.

In general, protein derived from vegetable foods is of less value to the body than protein derived from animal foods. It is, indeed, probable that no combination of vegetable proteins can support growth and lay the foundations of healthy vigorous manhood and womanhood as effectively as a mixture of vegetable and animal proteins. The Commission of the League of Nations referred to reported as follows :—

> "During growth, pregnancy and lactation, some animal protein is essential, and in the growing period it should form a large proportion of the total protein."

We may recommend that this proportion should be *at least* one fifth. The best source of animal protein for growing children is milk, derived from the cow or other species. It must be emphasised that skim milk is as rich in good protein as whole milk, and butter-milk of good quality is also a useful source. Eggs, fish, liver and muscle meat also contain proteins of high biological value.

Diets for growing children which do not contain a fair proportion of animal protein cannot be regarded as satisfactory. In devising " cheap balanced diets " in India the inclusion of animal protein in adequate amounts is the point which presents the greatest difficulty.

Data about the biological value of a number of proteins are given in Appendix I.

FAT.

Fat must be included in ordinary diets, but we have no exact knowledge of the quantity required. It is probably advisable that not less than 45—60 grammes (1½—2 ozs.) should be consumed daily. Most diets in India are low in fat. Fat is of value to the body in a number of ways, and a diet low in animal fat is often deficient in certain important vitamins. Animal fats, such as butter or ghee, contain vitamin A, while most vegetable fats and oils lack this factor. Ghee adulterated with vegetable oil may contain little or no vitamin A. There is one vegetable oil which is very rich in vitamin A activity, namely, red palm oil, which is obtained from the fruit of the palm *Elaeis guineensis*, grown in West Africa, Malaya and Burma. Apart from oils and fats which are consumed as such, the following foodstuffs are among those rich in fat : coconuts, nuts, soya bean, avocado pear.

CARBOHYDRATES.

Carbohydrates are the body's chief source of energy. Grain foods and root vegetables are largely composed of carbohydrates, and sugar is wholly carbohydrate. The carbohydrates are necessary constituents of the diet, but when, as commonly in India, they are present in excessive proportion, the diet becomes ill-balanced. In working out diet schedules, requirements. The needs of children of school age, which may possibly exceed those of adults, can be covered in the same way by a high intake of green leafy vegetables. In the case of infants and young children, and sickly and mal-nourished children of all ages, vitamin A may be supplied in the form of a daily dose of fish liver oil. The addition of cod liver oil increases the nutritive value of the diet of the average Indian child.

The vitamin A activity of any given foodstuff is variable, depending on a number of factors. That of milk and butter for example, fluctates according to the diet of the animal from which it is derived ; it has been observed in Europe that " summer " milk, obtained from cows fed on succulent green grass rich in carotene, contains more vitamin A than " winter " milk from stall-fed cows. Prolonged heating of ghee in an open pan may cause destruction of vitamin A. In the case of leafy vegetables, a good rough indication of carotene content is their greenness. The greener the better, and the fresher the better. Ordinary cooking does not destroy the carotene present in vegetables.

For a number of foods the Tables give a range of vitamin A and carotene content. In devising diets, a figure lying midway between the two extremes may be used. In the absence of information about the vitamin A activity of a vegetable food, it may be assumed that all green leafy vegetables are richly endowed in this respect, while other vegetables, cereals, legumes, etc., are less important sources of carotene.

Vitamin A deficiency is common in India, and care must be taken to ensure that diets supply a sufficiency of this vitamin. Reference to the effects of vitamin A deficiency will be made in a later section.

The B Vitamins.

A whole group of vitamins is included under this head.

Vitamin B_1, commonly known as the " anti-beriberi " vitamin, is found in unmilled cereals, pulses, eggs, fruits, nuts, most vegetables, glandular organs such as liver and to some extent in muscle meat and milk. A diet largely composed of milled rice contains insufficient vitamin B_1, and may give rise to beriberi, which is common in certain parts of India. Parboiled rice, even when milled, contains vitamin B_1.

The Vitamin B_1 requirements of school children and adults may be estimated at 300 international units per day. It is not difficult to ensure that a diet contains this quantity of the vitamin. If 4 ozs. of unmilled cereal, 6 ozs. of leafy and other vegetables and 2—3 ozs. of pulses are consumed daily, it is probable that enough vitamin B_1 will be obtained, even if the rest of the diet is composed of milled rice. The smaller the supply of vegetables, pulses, and fruits, the more important it becomes to avoid a preponderance of *milled* cereal in the diet. Even when nine-tenths of the diet is based on rice, beriberi will not usually follow if the rice is consumed in the " home-pounded " form. But if rice is subjected to several washings before consumption a great proportion of whatever vitamin B_1 it contains may be removed, and there will be a loss of mineral matter. Rice which is mouldy and full of weevils is likely to be subjected to most washing. Such rice is consumed by the very poor whose diet contains only small quantities of foods other than rice, and who are in the greatest need of the elements lost in washing.

It is noteworthy that milk, which is a good source of most of the important food factors, is not rich in vitamin B_1.

Vitamin B_2 (a term covering several vitamins) is an important food factor. The Tables give a rough idea of how it occurs in foodstuffs. All cereal foods are poor sources of it, milled rice being the poorest. Certain of the common pulses contain it fairly abundantly ; among these are Bengal gram, black gram, and red gram. Green leafy vegetables and certain roots and tubers, are fairly rich, but fruits in general probably do not contain much of this vitamin. Its richest sources are yeast, milk products (including skim milk, butter-milk, curds and cheese), lean meat, liver, eggs, pulses and green vegetables.

" Soreness " of the angles of the mouth and the tongue is probably caused by deficiency of vitamin B_2. It occurs most commonly in those whose diet consists largely of milled rice. Rapid cure follows the daily consumption of ½—1 oz. of dried yeast, ½ to 1 pint of good milk, or 2—3 eggs.

Vitamin C.

Vitamin C or ascorbic acid, the vitamin which prevents scurvy, is found in fresh fruits and vegetables. Among vegetables, the green leafy varieties are the best sources of this vitamin. When vegetables become dry and stale, most of the vitamin C originally present is destroyed.

Pulses and cereal grains in the ordinary state contain no vitamin C. When, however, they are allowed to sprout, the vitamin is formed in the grain and in the growing green sprouts. A method of causing grains to sprout is described in Sir Robert McCarrison's " Food " as follows :—

> "Dhal, gram, wheat, unsplit peas or any other grain is first soaked in water for 24 hours and is then spread out on damp earth or on a damp blanket and covered over with a moist cloth or sack (gunny bag) which is kept moist by sprinkling water upon it from time to time. After two or three days the grains will have sprouted and be ready for use ".
>
> " The sprouted grains should be eaten raw or after cooking for not more than 10 minutes ".

When fresh vegetables and fruits are not easily obtained, sprouted grains may be used as a cheap and easily available source of vitamin C. Sprouted pulses may contain 10—15 milligrammes of vitamin C per 100 grammes.

A well-balanced diet for school children and adults should contain some 30—50 mgs. of vitamin C per day. Vitamin C is sensitive to heat, and loss occurs in cooking, particularly if cooking is prolonged. Nevertheless, the inclusion of a few ounces of fresh fruit and leafy and other vegetables in a diet will ensure that its vitamin C content is satisfactory. In the case of infants fed on boiled fresh milk or re-constituted dried milk, special attention to vitamin C requirements is necessary. These can be met by giving fruit juice in small quantities.

Vitamin D.

Vitamin D, the vitamin which prevents rickets and osteomalacia, is found in liver and liver oils, egg yolk, and in milk and milk fat (*e.g.*, ghee) obtained from animals feding on green pastures and exposed to sunlight. Fish liver oil is its richest natural source. Vitamin D is formed in the skin by the action of sunlight, and hence rickets is particularly apt to occur in infants kept in dark houses, while osteomalacia in India is often found in the North among women who keep purdah. Probably minor degrees of rickets are more common in infants and young children throughout India than is generally supposed. Often the cheapest and easiest way of supplying vitamin D is by exposure of the body to sunlight. Cod liver oil and medicinal preparations of vitamin D cost money. The sun is free. There is a close connection between vitamin D and calcium and phosphorus requirements. When little vitamin D is obtained, and at the same time insufficient calcium is present in the diet, the danger of rickets and osteomalacia is increased. This is an additional reason why attention must be given to calcium intake.

An abundant intake of vitamin D helps to ensure the development of strong regular teeth. A good supply of this vitamin during pregnancy benefits the mother and helps to ensure the satisfactory future development of the child.

THE EFFECT OF COOKING ON NUTRITIVE VALUE.

The effect of heating and cooking on the nutritive value of foodstuffs is, on the whole, less pronounced than is generally imagined. Vitamin C is destroyed by moderate degrees of heat, and for this reason the inclusion of some raw fruit in the diet is desirable. When foods are cooked for prolonged periods in excessive quantities of water, some of the vitamins and salts they contain may pass into the water, and will be lost if the water is discarded. A considerable loss of phosphorus occurs during the washing and cooking of rice. The addition of washing soda (a strong alkali) to cooking water, for the preservation of colour or to facilitate cooking, tends to promote vitamin destruction. Conversely, a highly acid substance like tamarind has, when added to cooking water, a preservative effect. It must be added that we need more information about the effect of ordinary Indian methods of preparing and cooking foods on nutritive value.

MALNUTRITION.

It is advisable that those who are responsible for the institutional care of children, etc., and all who are concerned with practical nutrition work, should have some idea of the effects on the body of a diet which is ill-balanced and defective—*e.g.*, of a diet which is largely composed of milled cereals and contains an insufficiency of proteins, mineral salts and vitamins —and which calls for improvement. There is a long list of diseases, common in India, due in some way or other to dietetic causes. Such are : beriberi, certain anaemias of pregnancy, keratomalacia, osteomalacia. States of malnutrition which fall short of serious disease are wide-spread. A well-balanced diet is essential if growth and development are to take place normally. A badly fed child is often small for its age and thin ; its " weight for height " will be below average. it will fall sick easily. The frequency of minor ailments in school children can be reduced by improving the diet. A certain apathy, a lack of " pep ", of enthusiasm for work and play, is characteristic of the malnourished. The state of the skin is a sensitive index of faulty feeding ; a rough dry skin, or a skin covered with a papular eruption, suggests faulty feeding and in particular vitamin A deficiency. Everybody knows that a well-fed animal exhibits a certain glossiness and sleekness of fur—a " good coat "—which is not seen in poorly fed animals. Similarly a well-fed human being has a glossy skin and a glow of health. Bright clear eyes are also a sign of satisfactory feeding. Xerophthalmia (areas of dryness on the conjunctivae of the eyes sometimes covered with white exudative patches known as Bitot's spots) is associated with vitamin A deficiency. Sore-mouth and tongue and erosions at the angles of the mouth are found in ill-fed children ; in the properly fed child the tongue should be smooth and evenly coloured and not show enlarged papillae, fissures and areas denuded of the superficial epithelium. Such lesions, occuring most commonly in milled rice eaters, may be due to vitamin B_2 deficiency ; they can often be rapidly cured by increasing milk intake. Spongy bleeding gums suggest vitamin C deficiency—mild scurvy—and call for a greater consumption of fresh fruit and vegetables.

SUMMARY OF DIETETIC PRINCIPLES.

Human beings, and particularly children, cannot thrive at their best on a diet composed largely of cereals such as rice, millet, etc., and insufficiently supplemented by other foods. To make good the deficiencies of such a diet, they must consume fair quantities of foods like milk, green vegetables, eggs, fruits, etc. These are sometimes known as the " protective " foods, since they are rich in proteins, vitamins, and mineral salts and protect the body against the ills which result when the diet is largely based on less nutritious foods, such as milled rice. Cod liver oil, which is very rich in vitamins A and D, may for present purposes be classed as a most valuable " protective " food.

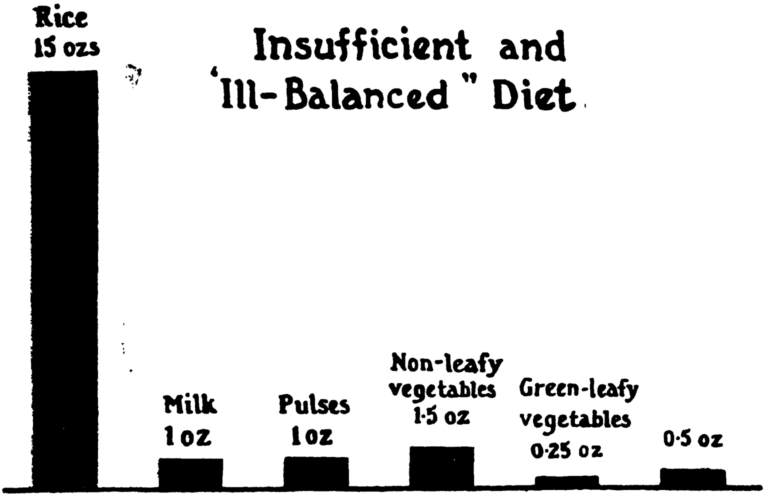
In general, diets in India are defective because they do not contain " protective " foods in sufficient abundance. *Our aim in public health nutrition work in general, and planning, " well-balanced " diets, must be to increase intake of " protective " foods.* The classes in the community which are particulary likely to suffer if their diet is defective are infants and growing children, and expectant and nursing mothers.

THE INVESTIGATION AND PLANNING OF DIETS.

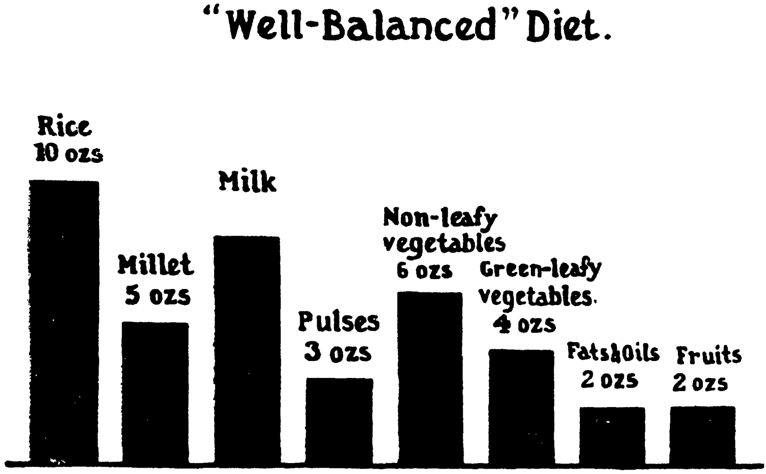
A concrete example will illustrate the methods to be followed in improving diets and drawing up satisfactory diet schedules. Let us suppose that the daily diet schedule of an institution, or of any group of people, works out as follows in amounts per consumption unit per day:—

	Ozs.
Milled rice	15·0
Milk	1·0
Pulses (dhal arhar)	1·0
Brinjal	1·0
Ladies fingers	0·5
Amaranth	0·25
Gingelly oil	0·50

This diet is shown diagrammatically in the Figure (the "ill-balanced" diet).



1750 Calories. less than average adult daily requirements.



2600 Calories. corresponding to average adult daily requirements.

An insufficient and ill-balanced diet compared with an adequate and well-balanced diet.

By reference to the Tables, the nutritive value of the ill-balanced diet can be worked out. Its content of calories, etc., is roughly as follows :—

Protein	38 gms.
Fat	19 gms.
Carbohydrate	357 gms.
Calories	1750
Calcium	0·16 gms.
Phosphorus	0·60 gms.
Iron	9·00 mgs.
Vitamin A (international units)	500
Vitamin B_1 ,,	160
Vitamin C	15·0 mgs.

It is at once apparent that this diet is insufficient in quantity and that it fails to supply the necessary requirements of any of the food factors enumerated. Such a diet, it may be remarked, is typical of diets consumed by millions in India.

The following adjustments might be made in a defective diet of this nature in order to make it adequate and " well-balanced ". The " well-balanced " diet is illustrated in the Figure.

			Ozs.
Raw milled rice			10
Cambu			5
Milk			8
Pulses	(dhal arhar 1 oz) (black gram 2 ozs)		3
Non leafy vegetables.	brinjal	2 ozs.	6
	ladies fingers	1 oz.	
	snake gourd	1 oz.	
	cluster beans	1 oz.	
	drumstick	1 oz.	
Leafy vegetables	amaranth leaves	2 ozs.	4
	drumstick leaves	1 oz.	
	spinach	1 oz.	
Gingelly oil			2
Fruit	mangoes	1 oz.	2
	ripe plantains	1 oz.	

Five ozs. of millet (cambu) replace a similar quantity of milled rice ; this increases intake of all the essential food factors, but notably that of protein and vitamin B_1. The additional milk supplies proteins of high biological value, calcium, and some vitamin A. The extra pulses increase total protein consumption and add calories. Intake of vegetables is greatly increased, with consequent all round improvement; the green leafy vegetables will be rich in vitamin A (carotene), a factor somewhat lacking in the remainder of the diet, and also in vitamin C. Two ozs. of fats and oils will provide a considerable addition of calories. The inclusion of fruit ensures that vitamin C requirements are more than fulfilled. The changes will also raise intake of vitamin B_2.

The composition of the " well-balanced " diet is roughly as follows :—

Protein	**73 gms.**
Fat	**74 gms.**
Carbohydrate	**408 gms.**
Calories	**2590**
Calcium	**1·02 gms.**
Phosphorus	**1·47 gms.**
Iron	**44·00 mgs.**
Vitamin A (international units)	**over 7000**
Vitamin B_1 ,,	**over 400**
Vitamin C ,,	**about 170·0 mgs.**

This diet contains enough calories to supply the requirements of an average man. All the important food factors are present in sufficient quantities, with a fair " margin of safety". The chief cereal in both the " ill-balanced " and " well-balanced " diets is milled rice. If, however, the staple cereal is wheat or millet, the principle of balance between the cereal and the other elements in the diet applies equally.

IMPROVEMENT IN RELATION TO COST.

Well-balanced diets are in general more expensive than deficient ones. For example, the " ill-balanced " diet shown in the diagram, which is largely composed of rice and contains very little milk, vegetables, or fruit, would cost about Rs. 2-8-0 per adult per month; the "well-balanced" diet, richer in milk and other foods, about Rs. 5 to 6. It is at this point that the nutrition worker encounters the main difficulty. Those who suffer from under-and mal-nutrition usually cannot afford to purchase a satisfactory diet. Many residential institutions for children in India, for example, are very short of money, and have often to feed their boarders on Rs. 3 per head per month or a good deal less. Now it is difficult, in fact impossible, to supply a really satisfactory diet for such sums.

But even when poverty prevents the purchase of a diet which satisfies modern standards of nutrition, it is often possible to make effective improvements with little increase in cost. It is desirable that children should consume upwards of 8 ozs. of milk a day—8 ozs. being an amount below that recommended as " optimum " by nutrition workers elsewhere. If available funds do not admit the addition of this quantity of whole milk, butter-milk, or skim milk reconstituted from skim milk powder, which are considerably cheaper, may be supplied. Even a little milk is better than none. Careful experiments have shown that the giving of 8 ozs. of skim milk daily to children fed on an average " ill-balanced " Indian diet results in an acceleration of growth and a great improvement in health and well-being. Such an addition is not very costly.

Diets in children's homes, and among the general population, are often low in fat. Addition of extra vegetable oil (at the expense of a quantity of cereal supplying an equivalent number of calories), does not greatly increase expenditure. Pure ghee or butter is, of course, preferable to vegetable fat, but very much dearer.

Other points to which attention should be given include the following:—If the cereal consumed is milled rice, an improvement in the nutritive value of the diet (and in the health of those consuming it) can be brought about by wholly or partially substituting whole rice, whole wheat, or one of the millets, particularly ragi. If milled rice remains the basis of the diet, it should be realised that the milled rice eater needs more "protective" foods—milk, green vegetables, fruits, etc.—than the consumer of whole rice or ragi. When the diet is almost wholly composed of rice—when people are so poor that they cannot afford to buy other foods except in minute quantities—then the state in which the rice is eaten becomes of paramount importance. Parboiled rice, even when milled, is superior in nutritive value (particularly as regards the anti-beriberi vitamin) to raw rice milled to the same degree.

Pulses are rich in protein and in the B vitamins. 2—3 ozs. per day increase the nutritive value of a diet largely composed of cereals. The soya bean is rich in protein, fat, and in vitamins A and B. If soya bean is to be widely used in India, considerable attention will have to be given to methods of preparing it in a palatable form. It does not seem, however, to have any advantage as a food for human beings over other pulses in common use in India, and the pluses in general are less valuable dietary supplements than animal foods such as milk, fish and meat.

Intake of green leafy vegetables should be not less than 4 ozs. per head per day. The cheaper varieties—amaranth leaves, coriander leaves, drumstick leaves, etc.—are as nutritious as the more expensive ones, such as lettuce. In children's homes the available supply of green vegetables could often be increased by creating a vegetable garden to be tended by the children themselves.

Fruits should always be included in children's diets. Plantains, a cheap fruit often supplied in hostels, are not of high nutritive value. Tomatoes and oranges and other "juicy" fruits are rich in vitamins and make a useful addition to diets of the poorer type.

PRACTICAL NUTRITION WORK IN GENERAL.

There are, of course, many kinds of public health nutrition work besides the planning of adequate diets. The task of the nutrition worker is often to make special additions (*e.g.*, milk, cod liver oil, various vitamin-rich preparations) to an unsatisfactory diet rather than to plan the whole diet afresh. Infant feeding is a special subject demanding special knowledge and training. But in all branches of practical dietetics the fundamental principles involved are the same, and an understanding of them is essential for successful work in this field.

Finally, it may be pointed out that it is not only the poor, whose choice in the matter of food is extremely limited, who are ignorant and prejudiced about diet. Plenty of people in India and elsewhere, who could afford to consume an excellent diet, and feed their children on an excellent diet, do not in fact do so. One can readily find, among children of the more prosperous classes, cases of serious malnutrition and food deficiency disease.

NOTE ON FOOD VALUE TABLES.

The foodstuffs analysed were mostly obtained in the local market, Coonoor. Foods which may be described as common Indian foods, consumed throughout the country, originated in the majority of cases in the neighbouring plains of the Coimbatore district; others of a kind less widely used in India (*e.g.*, European vegetables such as lettuce) were largely grown in the neighbourhood of Coonoor, 6,000 feet above sea level. Among the foods analysed were some from other parts of India, including North India. The edible portion of the foodstuff, in a fresh a state as possible, was used for the analysis. The method of analysis is described in a paper in the Indian Journal of Medical Research.*

The figures given represent percentages—*i.e.*, grammes per 100 grammes. Iron is expressed as milligrammes per 100 grammes. The great variety of Indian measures makes it difficult to supply metric and avoirdupois equivalents for the weights used in various provinces. In using the Bulletin in practice, the following conversion table may be useful:—

1,000 grammes (1 kilo) .. = 2·2 pounds (avoirdupois).
,, ,, ... = 87·5 tolas.
100 grammes .. .. = 3·5 ounces (avoirdupois).
,, ,, ... = 8·75 tolas.
1 pound (avoirdupois) .. = 453·6 grammes.
1 ounce (,,) .. = 28·4 ,,
1 tola .. .. = 11·4 ,,

The vitamin A and carotene figures are almost entirely based on spectrographic, assays while vitamin C was estimated chemically. In the case of vitamin B_1, use has been made of results appearing in various journals. The vitamin B_2 estimates are based on biological assay in the Coonoor Laboratories. No international unit has yet been established for vitamin B_2 or any of its components, and it has been found necessary to adopt the older method of reckoning values by means of signs. + + + indicates a very rich source; + + a good source; + means that the vitamin is present but not in large amounts; "poor" means that the vitamin is shown to be present by biological tests, but that the foodstuff so labelled should be regarded as an almost negligible source of the vitamin.

The absence of figures or estimates of vitamin content means that tests have not yet been carried out.

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* Ranganathan, *et al.* Indian Journal of Medical Research. 24. 3. January 1937.

TABLE OF

Cereals.

Name of foodstuff.	Botanical name.	Moisture %.	Protein %.	Fat (Ether Extractives). %	Mineral matter %.	Fibre %.	Carbohydrate %.
Arrow-root flour (West Indian).	Maranta arundinacea.	16·51	0·17	0·06	0·12	..	83·14
Bajra or cambu	Pennisetum typhoideum.	12·41	11·59	4·99	2·65	1·22	67·14
Barley ..	Hordeum vulgare	12·48	11·47	1·28	1·51	3·92	69·34
Cholam ..	Sorghum vulgare	11·88	10·42	1·93	1·76	..	73·99
Italian millet ..	Setaria Italica ..	11·23	12·31	4·65	3·24	7·95	60·62
"Kootu" ..	Fagopyrum esculentum.	11·33	10·26	2·36	2·42	8·60	65·03
Maize, tender ..	Zea mays ..	79·36	4·33	0·46	0·65	..	15·20
"Makhana" ..	..	12·75	9·70	0·14	0·52	..	76·89
Oatmeal ..	Avena sativa ..	10·68	13·55	7·59	1·78	3·46	62·94
Pani-varagu ..	Panicum miliaceum.	11·85	12·49	1·06	3·39	2·16	69·05
Ragi ..	Eleusine coracana.	13·05	7·10	1·29	2·21	..	76·32
Rice, raw, home-pounded.	Oryza sativa ..	12·19	8·49	0·35	0·70	..	78·27
Rice, parboiled home pounded.		12·63	8·50	0·39	0·86	..	77·62
Rice, raw, milled		12·96	6·85	0·55	0·50	..	79·14
Rice, parboiled. milled.		13·29	6·44	0·64	0·77	..	78·86
Rice, white, puttu.		12·97	7·51	0·37	0·40	..	78·75
Rice, black, puttu.		12·26	7·69	1·27	1·25	0·65	76·88
Rice, beaten		12·23	6·63	1·15	1·73	..	78·26
Rice, puffed.		14·68	7·46	0·12	3·41	..	74·33
Sago ..	Metroxylon sago..	12·20	0·24	0·17	0·30	..	87·09

FOOD VALUES.

Calcium (Ca) %.	Phosphorus (P) %.	Iron (Fe) mgs. %.	Calorific value per 100 gms.	Carotene (International Vitamin A units per 100 gms.).	Vitamin B₁* (International units per 100 gms.).	Vitamin B₂.	Vitamin C mgs. per 100 gms.	Remarks.
0·009	0·017	1·00	333·8	..	..	..	..	
0·049	0·352	8·84	359·9	220	110	Poor	..	
0·025	0·225	3·70	334·8	Trace	150	Poor	..	
0·027	0·282	6·18	352·8	136	..	Poor	..	
0·026	0·287	6·25	333·6	..	195	..	..	
0·068	0·299	13·20	322·4	..	300	..	..	
0·005	0·102	0·68	82·3	42	..	..	3·5	
0·016	0·091	1·38	347·6	Trace	..	..	..	
0·045	0·384	3·81	374·3	Trace	325	..	..	
0·014	0·333	5·72	335·7	..	..	..	..	
0·334	0·272	5·38	345·3	70	..	Poor	..	
0·007	0·165	2·22	350·2	..	100	Poor	..	
0·010	0·277	2·75	348·0	..	100			
0·007	0·108	1·02	348·9	0	26	Poor or none.		
0·007	0·149	2·22	347·0	0	100			
0·008	0·084	3·33	348·4	..			..	
0·012	0·241	4·93	349·7	..			..	
0·016	0·217	8·00	349·9	..			..	
0·024	0·162	6·15	329·1	..			..	
0·019	0·006	1·27	350·9	0	..	..	..	

end of Cereals table.

Cereals--*contd.*

Name of foodstuff	Botanical name.	Moisture %.	Protein %.	* Fat (Ether Extractives). %	Mineral matter %.	Fibre %.	Carbohydrate %.
Samai ..	Panicum miliare.	11·46	7·70	4·71	4·83	7·60	63·70
Sanwa millet ..	Panicum crusgalli var. frumantaceum.	11·87	6·22	2·23	4·44	9·83	65·41
" Singhara ", dry	Trapa bispinosa ..	13·76	13·43	0·83	3·07	..	68·91
Vermicelli ..	..	11·67	8·66	0·44	0·47	..	78·76
Varagu or Kodu millet.	Paspalum scrobiculatum.	12·77	8·31	1·37	2·92	8·97	65·66
Wheat, whole ..	Triticum vulgare	12·77	11·77	1·45	1·49	1·20	71·30
Refined wheat flour.	Triticum vulgare	13·30	11·00	0·90	0·40	0·30	74·10

* All whole grain foods are rich in vitamin B_1, while milled grains are largely vitamin B_1 after milling.

Calcium (Ca) %.	Phosphorus (P) %.	Iron (Fe) mgs. %.	Calorific value per 100 gms.	Carotene (International Vitamin A units per 100 gms.).	Vitamin B_1 (Intenrational units per 100 gms.).	Vitamin B_2.	Vitamin C mgs. per 100 gms.	Remarks.
0·015	0·364	7·08	328·0	Trace	..	Poor	..	
0·019	0·282	2·86	306·6	..	..	..	..	
0·069	0·443	2·35	336·8	..	..	..	..	
0·020	0·079	0·33	353·6	Trace	..	..	..	
0·039	0·242	5·17	308·2	..	..	..	..	
0·054	0·315	5·31	345·4	108	230	+	..	
0·020	0·092	1·00	348·5	..	..	..	..	

deprived of this vitamin. An exception is parboiled milled rice, which retains

Pulses.

Name of foodstuff.	Botanical name.	Moisture %.	Protein %.	Fat (Ether Extractives) %.	Mineral matter %.	Fibre %.	Carbohydrate %.
Bengal gram ..	Cicer arietinum ..	9·83	17·08	5·26	2·68	3·92	61·23
Bengal gram, roasted.	Do. ..	11·17	22·54	5·17	2·19	..	58·93
"Bhetmas" ..	Glycine hispida ..	8·80	41·29	16·95	4·49	4·25	24·22
Black gram ..	Phaseolus mungo	10·87	23·95	1·38	3·39	..*	60·41
Cow gram ..	Vigna catiang ..	12·00	24·56	0·69	3·23	3·75	55·77
Field bean, dry	Dolichos lablab ..	9·60	24·94	0·78	3·21	1·38	60·09
Green gram ..	Phaseolus radiatus	10·42	23·96	1·26	3·57	4·10	56·69
Horse gram ..	Dolichos biflorus	11·81	22·01	0·54	3·13	5·30	57·21
"Khesari" ..	Cicer arietinum ..	9·98	28·22	0·57	2·99	..	58·24
Lentil ..	Lens esculenta ..	12·44	25·10	0·74	2·13	..	59·56
Peas, dried ..	Pisum sativum ..	16·03	19·68	1·14	2·12	4·50	56·53
Peas, roasted ..	Do. ..	9·90	22·94	1·39	2·34	..	63·43
"Rajmah" ..	..	12·03	22·89	1·31	3·22	..	60·55
"Rawan" ..	Vigna catiang ..	12·67	23·40	1·28	2·92	..	59·73
Red gram (Dhal arhar).	Cajanus indicus	15·23	22·27	1·71	3·56	..	57·23
Soya bean ..	Glycine hispida ..	8·08	43·22	19·50	4·63	3·72	20·85

* Sprouted pulses contain 10—15 milligrammes

Calcium (Ca) %.	Phosphorus (P) %.	Iron (Fe) mgs. %.	Calorific value per 100 gms.	Carotene (International Vitamin A units per 100 gms.).	Vitamin B_1* (International units per 100 gms.).	Vitamin B_2.	Vitamin C mgs.* per 100 gms.	Remarks.
0·185	0·236	9·83	360·6	316	93	++	..	With outer husk.
0·067	0·311	8·89	372·4	..	..	..	..	Without outer husk.
0·213	0·603	9·88	414·6	..	..	..	..	
0·200	0·367	9·80	358·7	64	140	++	..	Without outer husk.
0·073	0·485	3·81	327·5	60	..	++	..	
0·063	0·446	1·98	347·1	Trace	..	None	..	
0·143	0·281	8·40	342·8	158	155	++	..	With outer husk.
0·275	0·385	7·59	321·7	158	..	Poor	..	
0·107	0·496	5·63	351·0	..	..	..	..	
0·130	0·250	1·98	345·4	450	150	+	..	
0·068	0·298	4·44	315·1	..	150	..	..	
0·033	0·357	5·00	358·0	..	..	..	..	
0·256	0·408	5·84	345·6	..	..	..	..	
0·075	0·430	4·31	344·0	..	..	..	..	
0·136	0·264	8·80	341·9	220	190	++	..	Without outer husk.
0·237	0·680	11·50	431·8	710	300	++	..	

of vitamin C per 100 grammes.

Leafy Vegetables.

Name of foodstuff.	Botanical name.	Moisture %.	Protein %.	Fat (Ether Extractives) %.	Mineral matter %.	Fibre %.	Carbohydrate %.
Amaranth, tender	Amaranthus gangeticus.	85·78	4·90	0·50	3·05	..	5·77
Amaranth, spined	Amaranthus spinoses.	85·00	3·00	0·25	3·61	..	8·14
Bamboo, tender shoots.	Bambusa arundinacea.	87·06	3·92	0·09	1·40	..	7·53
Brussels sprouts	Brassica oleracea bullata gemmifera.	84·57	4·68	0·46	1·02	..	9·27
Cabbage ..	Brassica oleracea capitata.	90·20	1·75	0·11	0·61	0·95	6·38
Celery ..	Apium graveolens rapaceum.	81·27	5·97	0·61	2·11	1·42	8·62
Coriander ..	Coriandrum sativum.	87·90	3·29	0·64	1·65	..	6·52
Curry leaves ..	Murraya koenigii	66·31	6·11	1·04	4·17	6·37	16·00
Drumstick ..	Moringa oleifera..	74·98	6·65	1·73	2·27	0·87	13·50
Fenugreek ..	Trigonella foenumgraecum.	81·78	4·86	0·86	1·57	1·04	9·89
Garden Cress ..	Lepidium sativum	82·30	5·79	0·96	2·16	..	8·79
" Gogu " ..	Hibiscus sabdariffa.	86·22	1·70	1·07	1·02	..	9·99
Ipomoea ..	Ipomoea reptans	90·33	2·90	0·40	2·11	..	4·26
Lettuce ..	Lactuca stiva ..	92·94	2·05	0·26	1·18	0·53	3·04
Mint	Mentha viridis ..	82·99	4·81	0·59	1·56	1·95	8·10
Neem, mature ..	Azedirachta indica	59·44	7·09	1·04	3·36	6·19	22·88
Neem, tender ..	Do. ..	59·36	11·56	2·97	2·61	2·22	21·28
Parsley ..	Petroselinum sativum.	68·42	5·93	0·97	3·17	1·80	19·71
" Agathi " ..	Sesbania grandiflora.	76·73	8·40	1·39	3·11	2·17	11·80
" Manathakkali "	Solanum nigrum	82·12	5·86	1·00	2·13	..	8·89
Spinach ..	Spinacia oleracea	91·66	1·92	0·85	1·50	..	4·07

Calcium (Ca) %.	Phosphorus (P) %.	Iron (Fe) mgs. %.	Calorific value per 100 gms.	Carotene (International Vitamin A units per 100. gms.).	Vitamin B_1 (International units per 100 gms.).	Vitamin B_2.	Vitamin C mgs. per 100 gms.	Remarks.
0·500	0·100	21·40	47·2	2,500—11,000.	29	+	172·9	
0·800	0·052	22·91	46·8	..	..	..	..	
0·016	0·088	0·11	46·6	Trace	..	..	..	
0·045	0·082	2·33	59·9	..	..	..	71·8	
0·034	0·046	0·76	33·5	2,000	50	..	124·2	
0·226	0·137	6·25	63·9	5,760 to 7,470.	Trace	..	62·4	
0·137	0·058	9·97	45·0	12,630	..	++	135·2	
0·811	0·057	3·09	97·8	12,600	..	++	4·2	
0·437	0·071	7·00	96·2	11,330	..			
0·472	0·047	16·90	66·7	3,860	..	..	..	
0·359	0·113	28·57	67·0	..	50	..	..	
0·181	0·038	5·38	56·4	..	..	..	..	
0·113	0·048	3·90	32·2	3,270	29	..	137·1	
0·051	0·030	2·39	22·7	2,200	90	..	14·9	
0·204	0·077	15·56	57·0	2,700	..	..	..	
0·514	0·080	17·14	129·2	..	..	..	..	
0·124	0·189	25·30	158·1	4,560	..	..	..	
0·392	0·195	17·86	111·3	3,200	..	..	280·8	
1·131	0·077	3·91	93·3	..	..	..	..	
0·410	0·074	20·51	68·0	..	..	..	11·3	
0·061	0·010	4·95	31·6	2,630 to 3,000.	70	..	47·7	

Roots and Tubers.

Name of foodstuff.	Botanical name.	Moisture %.	Protein %.	Fat (Ether Extractives) %.	Mineral matter %.	Fibre %.	Carbohydrate %.
Beet root ..	Beta vulgaris ..	83·81	1·65	0·05	0·75	..	13·74
Carrot ..	Daucus carota	86·00	0·92	0·07	1·03	1·18	10·75
Colocasia ..	Colocasia antiquorum.	73·05	2·95	0·10	1·72	..	22·18
"Onthalaigasu"		84·40	1·24	0·05	0·34	..	13·97
Parsnip ..	Pastinaca sativa	72·41	1·33	0·27	1·12	1·68	23·19
Potato ..	Solanum tuberosum.	74·73	1·73	0·13	0·61	..	22·80
Radish (pink) ..	Raphanus sativus	90·76	0·61	0·32	0·85	..	7·46
Radish (White)	Do. ..	94·41	0·70	0·06	0·58	..	4·25
Sweet potato ..	Ipomoea batatas	66·51	1·24	0·32	1·04	..	30·89
Tapioca ..	Manihot utilissima.	59·37	0·68	0·20	0·93	..	38·77
Yam (elephant)	Amorphophallus Campanulatus.	78·79	1·24	0·02	0·82	0·80	18·33
Yam (ordinary)	Typhonium trilobatum.	69·90	1·41	0·09	1·55	..	28·46

Calcium (Ca) %.	Phos-Phorus (P) %.	Iron (Fe) mgs. %.	Calorific value per 100 gms.	Carotene (International Vitamin A units per 100 gms.).	Vitamin B_1 (International units per 100 gms.).	Vitamin B_2.	Vitamin C mgs. per 100 gms.	Remarks.
0·195	0·057	0·98	62·0	0	70	..	<88	
0·082	0·030	1·52	47·3	2,020	60	..	2·5	
0·038	0·143	2·13	101·4	40	..	+	Trace	
0·013	0·024	0·53	61·3	..	..	..	..	
0·048	0·041	0·40	100·5	30	105	..	16	
0·004	0·034	0·68	99·3	40	40	++	17·3	
0·046	0·017	0·47	35·2	3	60	..	16·9	
0·054	0·025	0·40	20·3				15·0	
0·017	0·050	0·79	131·4	10	..	++	24·0	
0·045	0·039	0·92	159·6	..	..	..	..	
0·046	0·022	0·62	78·4	434	..	++	Trace	
0·061	0·016	1·30	120·3	..	24	..	Trace	

Other Vegetables.

Name of foodstuff.	Botanical name.	Moisture %.	Protein %.	Fat (Ether Extractives) %.	Mineral matter %.	Fibre %.	Carbohydrate %.
Amaranth, stem	Amaranthus gangeticus.	92·49	0·85	0·11	1·84	1·20	3·51
Artichoke ..	Cynara scolymus	77·27	3·64	0·14	1·75	1·20	15·99
Ash gourd ..	Benincasa cerifera	96·01	0·41	0·06	0·34	..	3·18
Bitter gourd ..	Momordica charantia	92·39	1·64	0·15	0·76	0·80	4·26
Bitter gourd (small variety).	Do. ..	83·16	2·87	0·98	1·43	1·70	9·86
Brinjal ..	Solanum melongena.	91·49	1·31	0·26	0·50	..	6·44
Broad beans ..	Dolichos lablab var. lignosus.	82·41	4·49	0·12	0·98	2·02	9·98
Calabash cucumber.	Lagenaria vulgaris	96·34	0·16	0·14	0·49	..	2·87
Cauliflower ..	Brassica oleracea botrytes.	89·43	3·51	0·41	1·36	..	5·29
"Cho-cho" marrow.	Sechium edule ..	92·53	0·70	0·11	0·41	..	6·25
Celery stalks ..	Apium graveolens rapaceum.	93·53	0·79	0·09	0·89	1·17	3·53
Cluster beans ..	Cyamopsis psoralioides.	82·45	3·67	0·17	1·35	2·26	10·10
Colocasia stems	Colocasia antiquorum.	93·44	0·34	0·34	1·20	0·59	4·09
Cucumber ..	Cucumis sativus..	96·42	0·45	0·06	0·31	..	2·76
Double beans ..	Faba vulgaris ..	73·75	8·28	0·27	0·94	..	16·76
Drumstick ..	Moringa oleifera..	86·88	2·53	0·11	1·96	4·80	3·72
French beans ..	Phaseolus vulgaris	91·43	1·74	0·11	0·53	1·80	4·39
Indian gooseberry	Emblica officinalis	81·21	0·52	0·09	0·68	3·42	14·08
Ipomoea, stems	Ipomoea reptans	93·67	0·83	0·20	1·76	..	3·54
Jack, tender ..	Artocarpus integrifolia.	84·01	2·61	0·31	0·91	2·78	9·38
Jack fruit seeds	Do. ..	51·60	6·60	0·36	1·54	1·45	38·45
"Kandan Kathiri"	Solanum xanthocarpum.	75·50	3·09	0·77	1·57	14·15	4·92
"Kovai" fruit, tender.	Coccinia indica ..	93·07	1·17	0·10	0·46	1·56	3·64
Knol-khol ..	Brassica oleracea caulorapa.	92·10	1·07	0·20	0·65	..	5·98
Ladies fingers ..	Hibiscus esculentus	87·95	2·20	0·20	0·74	1·15	7·76
Leeks ..	Allium porum ..	78·91	1·84	0·10	0·68	1·32	17·15

Calcium (Ca) %.	Phosphorus (P) %.	Iron (Fe) mgs. %.	Calorific value per 100 gms.	Carotene (International Vitamin A units per 100 gms.).	Vitamin B_1 (International units per 100 gms.).	Vitamin B_2.	Vitamin C mgs. per 100 gms.	Remarks.
0·263	0·034	1·80	18·4	..	..	..	..	
0·120	0·101	2·29	79·9	..	75	..	Trace	
0·025	0·017	0·45	14·9	Trace	21	..	0·9	
0·023	0·065	2·22	25·0	210	24	Poor	88·4	
0·045	0·144	9·35	59·7			..		
0·024	0·064	1·31	33·3	5	..	+	22·5	
0·045	0·055	1·61	59·0	..	..	..	12·2	
0·015	0·003	0·69	13·4	Trace	..	..	..	
0·034	0·061	1·25	38·9	38	110	..	65·8	
0·138	0·026	0·62	28·8	Trace		..	..	
0·033	0·038	4·76	18·1	..	..	..	5·7	
0·129	0·051	5·76	56·6	330	..	..	49·4	
0·062	0·024	0·50	20·8	..	..	..	..	
0·012	0·025	1·48	13·4	Trace	30	..	6·9	
0·036	0·142	2·27	102·6	..	..	..	22·4	Seeds only.
0·032	0·111	5·28	26·0	184	..	..	119·6	
0·048	0·025	1·67	25·5	221	26	..	13·8	
0·045	0·019	1·23	59·2	..	..	..	..	
0·081	0·027	0·78	19·3	..	..	..	..	
0·026	0·043	1·66	50·8	..	..	..	..	
0·049	0·133	0·16	183·4	..	..	..	..	
0·100	0·091	1·22	39·0	..	..	..	..	
0·037	0·030	1·35	20·1	260	..	..	28·0	
0·023	0·035	0·40	30·0	..	..	..	84·5	
0·094	0·078	1·54	41·6	58	21	+	15·6	
0·052	0·073	2·30	76·9	..	75	..	10·7	

Other Vegetables—contd.

Name of foodstuff.	Botanical name.	Moisture %.	Protein %.	Fat (Ether Extractives) %.	Mineral matter %.	Fibre %.	Carbohydrate %.
Mango, green ..	Mangifera indica	90·03	0·65	0·11	0·37	..	8·84
Nut of Avocado pear.	Persea drymifolia	63·67	2·52	0·71	1·10	..	32·00
Onion, stalk ..	Alium cepa ..	87·64	0·94	0·24	0·77	1·60	8·81
Peas, English ..	Pisum sativum ..	72·09	7·18	0·12	0·75	..	19·86
Pink beans ..	Phaseolus vulgaris	88·49	2·44	0·18	0·58	2·10	6·21
Plantain flower	Musa paradisiaca	90·22	1·45	0·19	1·21	1·93	5·00
Plantain, green	Do. ..	83·24	1·41	0·23	0·51	..	14·61
Plantain stem	Do. ..	83·26	0·48	0·05	0·61	0·76	9·84
Pumpkin ..	Cucurbita maxima	92·60	1·36	0·07	0·58	..	5·39
Rhubarb stalks	Rheum Rhaponticum.	92·74	1·10	0·51	1·05	0·85	3·75
Ridge gourd ..	Luffa acutangula	95·43	0·52	0·12	0·34	..	3·59
"Singhara" or water chestnut.	Trapa bispinosa	70·01	4·67	0·29	1·07	..	23·96
Snake-gourd ..	Trichosanthes anguina.	94·06	0·46	0·31	0·70	..	4·47
Spinach stalks	Spinacia oleracea	93·37	0·87	0·14	1·82	..	3·80
"Sundakai", dry	Solanum torvum	12·25	8·31	1·66	5·09	17·58	55·11
Tomato, green	Lycopersicum esculentum.	92·81	1·88	0·06	0·68	..	4·57
Turnip ..	Brassica rapa ..	91·10	0·52	0·23	0·60	..	7·52
Vegetable marrow	Cucubita pepo ..	94·84	0·48	0·09	0·27	..	4·32

Calcium (Ca) %.	Phosphorus (P) %.	Iron (Fe) mgs. %.	Calorific value per 100 gms.	Carotene (International Vitamin A units per 100 gms.).	Vitamin B$_1$ (International units per 100 gms.).	Vitamin B$_2$.	Vitamin C mgs. per 100 gms.	Remarks.
0·012	0·017	4·48	39·0	150	..	..	3·2	
0·018	0·083	1·19	144·5	..	..	..	..	
0·048	0·054	7·50	41·2	..	..	..	..	
0·019	0·078	1·47	109·2	139	120	..	9·2	
0·035	0·039	1·24	36·2	..	..	..	<27·7	
0·034	0·048	0·12	27·5	..	..	..	..	
0·005	0·027	0·60	66·2	50	15	++	23·9	
0·009	0·005	1·06	41·7	..	..	..	..	
0·009	0·030	0·67	27·6	84	20	..	2·0	
0·119	0·012	2·20	24·0	..	0	..	36·7	
0·035	0·040	1·58	17·5	56	22	..	..	
0·024	0·154	0·82	117·1	20	..	..	..	
0·045	0·024	1·28	22·5	160	..	..	Trace	
0·090	0·015	1·34	19·9	..	..	..	2·9	
0·370	0·179	22·22	268·6	750	..	..	..	
0·016	0·039	2·37	26·3	320	23	..	31·3	
0·028	0·035	0·42	34·2	Trace	40	..	43·4	
0·002	0·026	0·63	20·0	Trace	..	..	17·8	

Nuts and Oil Sedes.

Name of foodstuff.	Botanical name.	Moisture %.	Protein %.	Fat (Ether Extractives) %.	Mineral matter %.	Fibre %.	Carbohydrate %.
Almond ..	Prunas amygdalis	5·23	20·75	58·92	2·90	1·70	10·50
Cashew nut ..	Anacardium occidentale.	5·89	21·19	46·93	2·43	1·27	22·29
Coconut ..	Cocos nucifera ..	36·28	4·47	41·60	0·96	3·59	13·19
Gingelly seeds ..	Sesamum indicum	5·08	18·33	43·26	5·20	2·88	25·25
Ground-nut ..	Arachis hypogea	7·92	26·72	40·13	1·87	3·07	20·29
Ground-nut, roasted.	Do. ..	4·04	31·54	39·76	2·28	3·07	19·31
Linseed (seeds) ..	Linum usitatissimum.	6·57	20·27	37·11	2·44	4·80	28·81
Mustard seeds ..	Brassica juncea ..	8·46	22·04	39·64	4·19	1·80	23·87
Pistachio nut ..	Pistacia vera ..	5·58	19·81	53·51	2·75	2·10	16·25
Walnut ..	Juglans regia ..	4·53	15·64	64·49	1·84	2·60	10·90

Fats and oils of vegetable origin derived from oilseeds, etc., are in general devoid

lcium (Ca) %.	Phosphorus (P) %.	Iron (Fe) mgs. %.	Calorific value per 100 gms.	Carotene (International Vitamin A units per 100 gms.).	Vitamin B_1 (International units per 100 gms.).	Vitamin B_2.	Vitamin C mgs. per 100 gms.	Remarks.
0·225	0·492	3·47	655·3	..	80	..	..	
0·053	0·449	4·95	596·3	100	..	+	..	
0·013	0·243	1·70	444·7	Trace	Trace	Poor	0·8	
1·453	0·574	10·54	563·7	107	..	..	..	
0·048	0·392	1·56	549·2	63	300	+	..	
0·045	0·435	0·29	561·2	..	..	..	..	
0·173	0·371	2·65	530·3	..	..	..	..	
0·488	0·704	17·88	540·4	270	..	..	Trace.	
0·136	0·431	13·70	625·8	..	..	..	..	
0·095	0·384	4·76	686·6	..	150	..	..	

of carotene and vitamin A. Red palm oil is an exception (see p. 5).

Name of foodstuff.	Botanical name.	Moisture %.	Protein %	Fat (Ether Extractives) %.	Mineral matter %.	Fibre %.	Carbohydrate %.
"Arisithippili"	Piper clusii ..	12·53	13·24	4·66	6·03	5·17	58·37
Asafoetida ..	Ferula narthex ..	16·03	3·95	1·13	6·99	4·12	67·78
Cardamom ..	Elettaria cardamomum.	19·95	10·21	2·18	5·37	20·10	42·19
Chillies, green ..	Capsicum annuum	82·60	2·87	0·59	1·04	6·73	6·17
Chillies, dry ..	Do. ..	10·02	15·88	6·24	6·10	30·15	31·51
Cloves ..	Eugenia caryophyllata.	23·29	5·24	8·90	5·20	9·54	47·83
Coriander ..	Coriandrum sativum.	11·15	14·08	1·04	4·39	32·58	36·76
Cumin ..	Cuminum cyminum.	11·94	18·71	0·58	5·84	11·98	50·95
Fenugreek seeds	Trigonella foenum-graecum.	13·70	26·19	5·77	3·00	7·16	44·18
Garlic ..	Allium sativum ..	62·79	6·31	0·13	1·02	0·80	28·95
Ginger ..	Zingiber officinale	80·86	2·33	0·94	1·19	2·42	12·26
"Kandanthippili."	Piper roxburghii	12·24	6·44	2·32	4·77	8·51	65·72
Mace ..	Myristica fragrans	15·92	6·51	24·36	1·58	3·76	47·87
Mustard ..	Brassica juncea ..	8·46	22·04	39·64	4·19	1·80	23·87
Nutmeg ..	Myristica fragrans	14·32	7·49	36·44	1·72	11·59	28·44
Omum ..	Carum copticum	8·92	15·41	18·08	7·09	11·87	38·63
Onion, big ..	Allium cepa ..	86·76	1·22	0·04	0·36	..	11·62
Onion, small ..	Do. ..	84·33	1·80	0·08	0·55	..	13·24
Pepper, dry ..	Piper nigrum ..	12·86	11·53	6·79	4·40	14·92	49·50
Tamarind ..	Tamarindus indicus.	20·86	3·06	0·14	2·86	5·57	67·51
Turmeric ..	Curcuma longa ..	13·08	6·33	5·10	3·51	2·60	69·38

Fruits.

Name of foodstuff.	Botanical name.	Moisture %.	Protein %.	Fat (Ether Extractives) %.	Mineral matter %.	Fibre %.	Carbohydrate %.
Apple ..	Pyrus malas ..	85·94	0·31	0·08	0·27	..	13·40
Banana ..	Musa sapientum	61·39	1·33	0·15	0·72	..	36·41
Bullock's heart	Anona reticulata	76·79	1·39	0·16	0·74	..	20·92
Cape goose-berry	Physalis peruviana	82·69	1·78	0·17	0·59	3·19	11·58
Dates (Persian)	Pheonix dactylifera.	26·11	3·04	0·16	1·31	2·07	67·31
Figs ..	Ficus carica ..	80·80	1·31	0·23	0·64	..	17·02
Grapes (Blue variety).	Vitis vinifera ..	85·51	0·83	0·10	0·43	3·00	10·13
Grape fruit (Triumph).	Citrus grandis var. maxima.	92·04	0·71	0·03	0·20	..	7·02
Grape fruit (Marsh's seedless).	Do. ..	88·51	0·95	0·06	0·35	..	10·13
Guava, country	Psidium guyava	76·07	1·46	0·19	0·81	6·90	14·57
Guava, Hill ..	Psidium catelianum.	85·31	0·95	0·16	0·61	4·82	8·15
Jack fruit ..	Artocarpus integrifolia.	77·20	1·86	0·10	0·78	1·09	17·88
Jambu fruit ..	Eugenia jambos	78·21	0·67	0·10	0·41	0·87	19·74
" Korukkapalli "	Pithecolobium dulce.	80·78	2·57	0·31	0·41	..	15·93
Lemon ..	Citrus medica var. var. limonum.	84·97	0·98	0·85	0·26	1·65	11·29
Lime ..	Citrus medica var. acida.	84·57	1·49	0·97	0·64	1·25	11·08
Mango, green ..	Mangifera indica	90·03	0·65	0·11	0·37	..	8·84
Mango, ripe ..	Do. ..	86·14	0·64	0·07	0·32	1·14	11·69
Mango, "Ankola"	Do. ..	85·94	1·02	0·11	0·46	..	12·46
Melon, water ..	Citrullus vulgaris	95·70	0·12	0·15	0·22	..	3·81
Orange ..	Citrus aurantium	87·84	0·85	0·32	0·43	..	10·56
Palmyra fruit,	Borassus flabellifer	92·72	0·58	0·02	0·17	..	6·51

alcium (Ca) %.	Phosphorus (P) %.	Iron (Fe) mgs. %.	Calorific value per 100 gms.	Carotene (International Vitamin A units per 100 gms.).	Vitamin B_1 (International units per 100 gms.).	Vitamin B_2.	Vitamin C mgs. per 100 gms.	Remarks.
0·013	0·021	1·68	55·0	Trace	40	..	2·1	
0·002	0·045	0·42	147·6	Trace	50	..	1·0	
0·014	0·009	0·63	90·7	..	..	..	..	
0·006	0·058	1·80	55·0	..	..	..	49·0	
0·067	0·076	10·58	282·8	600	30	+	Trace	Preserved fruits.
0·055	0·026	1·16	75·4	..	..	..	2·4	
0·025	0·019	0·40	44·7	15	Trace	..	2·5	
0·017	0·021	0·18	31·2	..	40	..	31·2 (Juice).	
0·025	0·027	0·20	44·9	..		..		
0·013	0·040	1·04	65·8	100	..	..	299·0	
0·046	0·022	1·20	37·8	..	..	..	15·0	
0·022	0·028	0·46	79·9	540	..	..	10	
0·016	0·011	1·00	82·5	..	..	..	..	
0·011	0·036	0·37	76·8	..	..	..	..	
0·070	0·014	2·33	56·7	..	..	..	38·5 (Juice).	
0·091	0·021	0·29	59·0	120	..	..	62·5 (Juice).	
0·012	0·017	4·48	39·0	150	..	..	3·2	
0·007	0·020	0·25	50·0	4,800	..	Poor	..	
0·004	0·016	0·45	55·0	1,860	..	..	23·6	
0·001	0·008	0·15	17·1	Trace	..	..	1·0	
0·046	0·022	0·08	48·5	350	40	..	67·7	
0·005	0·021	0·46	28·5	..	..	..	..	

Fruits-

Name of foodstuff.	Botanical name.	Moisture %.	Protein %.	Fat (Ether Extractives) %.	Mineral matter %.	Fibre %.	Carbohydrate %.
Papayya, ripe ..	Carica papaya ..	89·62	0·47	0·03	0·38	..	9·50
Peaches ..	Amygdalis persica	90·07	1·52	0·19	0·58	..	7·64
Pears, country ..	Pyrus communis..	86·92	0·18	0·05	0·27	1·00	11·58
Pears, English ..	Pyrus Achras ..	85·84	0·94	0·23	0·23	..	12·76
Pears, Avocado or Butter fruit.	Persea drymifolia	73·55	1·68	22·81	1·05	..	0·91
Pine apple ..	Ananas sativus ..	86·50	0·57	0·04	0·49	0·40	12·00
Plantain (Ordinary).	Musa paradisiaca	73·35	1·06	0·08	0·72	..	24·79
Plantain, Hill "Anaikombu"	Musa paradisiaca	79·93	1·22	0·06	0·80	..	17·99
Plums (Red variety).	Prunus domestica	89·82	0·68	0·22	0·36	..	8·92
Pomegranate ..	Punica granatum	78·00	1·63	0·04	0·67	5·10	14·56
Pomeloe ..	Cirtus decumana	88·10	0·63	0·04	0·51	0·60	10·12
Quince ..	Cydonia vulgaris	85·76	0·28	0·04	0·33	1·72	11·87
Raisins (preserved).	Vitis vinifera ..	18·47	1·96	0·18	1·98	..	77·41
Strawberry ..	Fragaria grandiflora.	87·82	0·71	0·18	0·38	1·14	9·77
Tomato, ripe ..	Lycopersicum esculentum.	94·52	1·02	0·08	0·48	..	3·90
Tree Tomato ..	Cyphomandra betacea.	82·72	1·46	0·21	1·12	4·15	10·34
Wood apple ..	Feronia elephantum.	69·54	7·31	0·56	1·88	5·16	15·55
Tamarind ..	Tamarindus indicus.	20·86	3·06	0·14	2·86	5·57	67·51

Calcium (Ca) %.	Phosphorus (P) %.	Iron (Fe) mgs. %.	Calorific value per 100 gms.	Carotene (International Vitamin A units per 100 gms.).	Vitamin B_1 (International units per 100 gms.).	Vitamin B_2.	Vitamin C mgs. per 100 gms.	Remarks.
0·013	0·009	0·42	40·2	2,020	..	..	45·5	
0·006	0·029	1·70	38·4	Trace	..	..	1·0	
0·006	0·011	0·68	47·5	14	..	..	Trace	
0·005	0·016	0·84	56·9	80	30	..	1·0	
0·011	0·076	0·71	215·7	..	..	..	13·0	
0·021	0·007	0·92	50·6	98	..	..	62·9	
0·011	0·031	0·50	104·1	124	..	Poor	5·5	
0·007	0·025	0·27	77·4	124	..	..	8·5	
0·017	0·018	0·55	40·4	230 (Yellow variety).	40	..	0·6	
0·009	0·066	0·27	65·1	0	..	..	15·6	
0·028	0·027	0·04	43·4	200	..	..	..	
0·005	0·015	0·44	49·0	..	..	..	10·0	
0·101	0·075	3·98	319·1	..	75	..	Trace	
0·026	0·026	1·75	43·5	..	..	..	52·0	
0·008	0·018	0·08	20·4	320	40	..	32·2	
0·013	0·029	0·71	43·3	..	..	..	Trace	
0·127	0·107	0·62	96·5	..	..	..	..	
0·172	0·110	10·90	283·5	100	..	..	2·6	

Flesh Foods.

Name of food-stuff.	Moisture. %.	Protein %.	Fat (Ether Extractives) %.	Mineral matter %.	Fibre %.	Carbohydrate %.	Calcium (Ca) %.
Beef (muscle) ..	74·33	22·61	2·58	0·99	..	..	0·004
Crab (muscle) ..	83·49	8·87	1·07	3·20		3·37	1·370
Egg, duck ..	71·00	13·54	13·72	1·03	..	0·70	0·073
Egg, fowl ..	73·65	13·33	13·32	0·95	..	..	0·056
Fish (Mangalore, big fish).	78·38	22·60	0·06	0·83	..	..	0·020
Fish, (Mangalore, small fish).	77·89	21·49	1·63	2·03	..	..	0·055
Fish, " Vajra " ..	79·41	19·92	1·51	1·38	..	..	0·044
Liver, sheep ..	70·37	19·29	7·49	1·45	..	1·40	0·006
Mutton (muscle) ..	71·46	18·54	13·30	1·26	..	..	0·147
Pork (muscle) ..	77·41	18·66	4·40	1·01	..	..	0·034
Prawn (muscle) ..	77·94	20·84	0·28	1·42	..	..	0·088

Phosphorus (P) %.	Iron (Fe) mgs. %.	Calorific value per 100 gms.	Vitamin A (International units per 100 gms.).	Carotene. (International Vitamin A units per 100 gms.).	Vitamin B_1 (International units per 100 gms.).	Vitamin B_2.	Vitamin C mgs. per 100 gms.	Remarks.
0·190	0·77	113·7	59·0	0	50	++	..	
0·147	21·20	58·6	Trace	1,300	..	..	..	
0·261	2·97	180·4	1,233	..	..	..	..	
0·271	2·07	173·2	1,197	1,000	..	..	..	
0·185	0·83	90·9	25·6	9·0	..	Poor	..	Types of fish commonly consumed in Malabar.
0·413	2·28	100·6						
0·379	0·72	93·3						
0·378	6·30	150·2	22,308	0	120	..	..	
0·151	2·52	193·9	30·8	0	60	..	..	
0·198	2·27	114·2	Trace	..	320	..	..	
0·244	0·79	85·9	Trace	Trace	<30	..	..	

Milk and Milk Products.

Name of food-stuff.	Moisture %.	Protein %.	Fat (Ether Extractives) %.	Mineral matter %.	Fibre %.	Carbohydrate %.	Calcium (Ca) %.
Milk, cow's ..	87·60	3·30	3·60	0·70	..	4·80	0·120
Milk, buffalo's ..	82·30	4·75	7·70	0·80	..	4·45	0·203
Milk, goat's ..	86·30	3·60	4·00	0·80	..	5·30	0·128
Milk, human ..	87·58	1·18	3·74	0·30	..	7·20	0·034
Butter-milk ..	97·54	0·84	1·08	0·14	..	1·40	0·030
Curds ..	90·31	2·86	2·94	0·59	..	5·30	0·120
Skim milk powder	4·10	38·04	0·09	6·83	..	50·94	1·370
Cheese ..	40·30	24·10	25·10	4·20	..	6·30	0·786

Phosphorus (P) %.	Iron (Fe) mgs. %.	Calorific value per 100 gms.	Vitamin A (International units per 100 gms.).	Carotene (International Vitamin A units per 100 gms.).	Vitamin B_1 (International units per 100 gms.).	Vitamin B_2.	Vitamin C mgs. per 100 gms.	Remarks.
0·093	0·24	66·8	180	0	..	++	..	
0·125	..	106·1	162	0	..	..	..	
0·103	..	71·6	182	0	..	..	..	
0·015	..	67·2	208	0	..	..	..	
0·030	0·78	18·7	0	0	..	++	..	
0·088	0·31	59·1	Trace	Trace	..	++	..	
0·995	1·43	356·7	0	0	165	+++	..	
0·524	2·10	347·5	273	..	..	..	..	

Miscellaneous Foodstuffs.

Name of food-stuff.	Moisture %.	Protein %.	Fat (Ether Extractives) %.	Mineral matter %.	Fibre %.	Carbohydrate %.	Calcium (Ca.) %.
Betel leaves (*Piper betel*).	85·41	3·07	0·80	2·25	2·33	6·14	0·227
Jaggery ..	3·93	0·36	0·06	0·62	..	95·03	0·075
" Pappads " ..	20·32	18·76	0·33	8·17	..	52·42	0·080
" Perandai " (*Vitis quadran gularis*).	87·42	1·21	0·34	2·01	1·83	7·19	0·651
Sweet toddy ..	84·72	0·10	0·17	0·66	..	14·35	0·149
Cod liver oil	..	..	100·0	..	..	..	..
Halibut liver oil ..	..	..	100·0	..	..	..	..
Red Palm oil (*Elaeis guineensis*).	..	..	100·0		..	..	..

Phosphorus (P) %.	Iron (Fe) mgs. %.	Calorific value per 100 gms.	Vitamin A (International units per 100 gms.).	Carotene. (International Vitamin A units per 100 gms.).	Vitamin B_1 (International units per 100 gms.).	Vitamin B_2.	Vitamin C mgs. per 100 gms.	Remarks.
0·044	5·74	44·0	0	9,635	..	..	4·8	
0·038	11·40	382·1	..	280	..	..	..	
0·298	17·24	287·7	..	Trace	..	..	..	
0·050	2·12	36·7	..	..	..	..	..	
0·011	0·26	59·3	..	..	..	Poor	..	
..	..	900·0	45,000 to 168,000.	0	..	..	..	
..	..	900·0	3,900,000	0	..	..	..	
..	..	900·0	0	44,000	..	..	..	

APPENDIX I.

Table showing the biological value of the proteins in certain foodstuffs.

Foodstuff.	Biological Value.
Barley	71
Cambu	83
Cholam	83
Maize, tender	60
Oatmeal	65
Ragi	89
Rice, raw polished	80
Wheat, whole	67
Bengal gram	76
Black gram	64
Cow pea	61
Dew gram	57
Field pea	72
Green gram	51
Horse gram	59
Lentil	41
Navy beans	38
Red gram	74
Soya bean	54
Amaranth leaves	72
Cabbage leaves	76
Drumstick leaves	41
Ipomoea leaves	67
Potato	67
Sweet potato	72
Brinjal	71
Ladies fingers	82
Coconut	58
Linseed	78
Peanut, raw	58
Peanut, roasted	56
Beef liver	77
Beef, muscle	98
Whole egg	94
Milk	85
Cocoa	37

APPENDIX II.

Table showing the percentage of "available" iron in certain foodstuffs.

Foodstuff.	Percent of "available" iron.
Wheat	47
Oats	57
Yeast	47
Lima beans	72
Navy beans	61
Peas (canned)	90
Peas (fresh)	72
Soya bean (roasted)	60
Soya bean (non-roasted)	80
Parsley (dry)	23
Lettuce	25
Spinach (fresh)	19
Spinach (dry)	20
Raisins (bleached, seedless)	30
Raisins (Muscat)	62
Apricots	50
Almonds	88
Bananas	61
Alfalfa	27
Oysters (dry)	25
Beef, skeletal muscle (dry)	50
Beef heart muscle (dry)	70
Pork heart muscle (dry)	86
Beef liver (dry)	70
Pork liver (dry)	66
Beef kidney	40